High cell-density processes in batch mode of a genetically engineered Escherichia coli strain with minimized overflow metabolism using a pressurized bioreactor.

Knabben I, Regestein L, Marquering F, Steinbusch S, Lara AR, Büchs J (2010) High cell-density processes in batch mode of a genetically engineered Escherichia coli strain with minimized overflow metabolism using a pressurized bioreactor. *J Biotechnol* 150(1), 73-79.

Abstract

A common method to minimize overflow metabolism and to enable high cell-density is to operate microbial processes in fed-batch mode under carbon-limiting conditions. This requires sophisticated process control schemes with expensive hardware equipment and software and well-characterized processes parameters. To generate high-cell density, a more simplified strategy would be beneficial. Therefore, a genetically engineered Escherichia coli strain with a modified glucose uptake system was cultivated in batch mode. In the applied strain, the usual phosphotransferase system of a K12-derived strain was inactivated, while the galactose permease system was amplified. Upon cultivating this E. coli strain in pure minimal media, the acetate concentration did not exceed values of 0.35 g L(-1), even when the batch fermentation was started with a glucose concentration of 130 g L(-1). Finally, maximum biomass concentrations of 48 g L(-1) dry cell weight and maximum space-time yields of 2.10 g L(-1) h(-1) were reached. To provide an unlimited growth under fully aerobic conditions (DOT>30%) at comparatively low

values for specific power input (3-4 kW m(-3)), a pressurized bioreactor was used. Consequentially, to our knowledge, this study using a bioreactor with elevated headspace pressure generate the highest oxygen transfer rate (451 mmol L(-1) h(-1)) ever reached in batch cultivations.

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